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Effect of Texting with Friends during Video Lectures on High School Students' Learning

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Abstract: *The purpose of this study was to examine high school students' learning by looking at the effect of texting with friends through a computer chat program on their comprehension and memory of video lectures. Two videos were selected and two settings (texting and no-texting settings) were created. Students were asked to watch one video while being interrupted by a friend to text with them, and to watch another video without being interrupted. The results of the students' video lecture comprehension and memory quizzes showed that the students scored lower while texting with friends, and that they scored differently between the two videos when texting with friends.*

Keywords: learning environment, multitasking, texting, cognitive overload, distraction

1. Introduction

Intuitively, one might expect that the introduction of media extraneous to the learning environment during a learning event could adversely impact comprehension, memory, and ultimately, learning outcomes. A study by Foerde, Poldrack, and Knowlton (2007) demonstrated that the introduction of a concurrent task impeded performance of a probabilistic classification task while interfering with the attainment of explicit knowledge. Dietz and Henrich (2014) conducted an experiment with 99 college students in which not only did the concurrent

task of texting adversely impact learning, but also that no mitigating factors existed including texting frequency and capability. However, neither intuition nor research has stopped students from texting in the classrooms. Is it true that the new generations of "digital natives" have developed the capability to do multiple tasks such as texting while listening to a lecture, as claimed by some scholars (e.g., Prensky, 2001)?

The current study set out to examine high school students' ability to text with friends during lectures, a common phenomenon in contemporary learning environments.

Given the proliferation of portable connective devices both within and outside of classroom environments, there exists the need to understand the implications of using these devices in instructional settings. This study examines such implications within the contexts of comprehension and memory.

2. Background and Conceptual Framework

It is common to see students check their Facebook or text with friends using mobile or computer instant messaging programs while studying or listening to a lecture. Gupta and Irwin (2016) found that when students attended to Facebook in class, learning performance was compromised. Additionally, the less engaged the students were with their learning tasks, the more easily distracted they were by Facebook. In a survey conducted by Jacobsen and Forste (2011), about two-thirds of the American college students reported using digital media while in class, studying or doing homework. Tindell and Bohlander (2012) reported that 91% of American college students had sent or received a text message in their university class and 62% felt texting is acceptable in class if it does not disturb other students. Research has shown that media multitasking has negatively affected learning during lectures, grades, GPA, studying, and doing homework (Carrier, Rosen, & Cheever, 2015). With regard to homework, Calderwood, Green, Joy-Gaba, and Moloney (2016) revealed that the majority of students expect media multitasking to impair both performance and self-control, and choose to media multitask anyway. Kinzie et al. (2005) found that the college student participants had trouble dividing their attention between a lecture and the chatting task on the given hand held devices. Rosen et al (2011) found that students' learning from a lecture was negatively affected by their sending and receiving text messages. In Burak's study

(2012), there was a significant association between the students' self-reported classroom multitasking, particularly texting, and their GPAs.

However, the drawbacks of media multitasking are more complex than absolute. Lin, Robertson and Lee (2009) conducted a study examining college students' reading comprehension in three different conditions – silence, background (reading articles while having TV in the background with the option to ignore the TV), and test (being “required” to read articles and watch TV at the same time) conditions. The authors found that the students had better reading scores when they were asked to read articles with TV playing in the background than when they were asked to read the articles in complete silence (Lin, Robertson, & Lee, 2009; Lee, Lin, & Robertson, 2012). The authors also found that the content of the media, for instance, a comic video as compared to a documentary video, made a difference to the learners' performances on their primary reading tasks and on their secondary video tasks (Lin, Lee, & Robertson, 2011). Further, the authors discovered that the learners' goals – to complete tasks as quickly as possible as compared to complete tasks as accurately as possible – made a difference in their multitasking performances. The learners performed better on both the primary reading tasks and the secondary video tasks when they were encouraged to complete the tasks as quickly as possible (Lin, Robertson, & Lee, 2012). A study on memory and note taking abilities in different media environments also revealed that there were significant interactions between media environments and note-taking options (Lin & Bigenho, 2011). Scholars have also found that the students who are heavy media multitaskers (those who multitask regularly) have an advantage over light media multitaskers 1) during tasks that require the integration of multiple incoming

information streams, for example when auditory information informs visual target detection (Lui & Wong, 2012) and 2) when they had to switch tasks quickly (Alzahabi & Becker, 2013).

To date, most studies investigating effects associated with media multitasking have investigated college-aged populations. However, it is arguably just as important if not more, to find the causes and directions of multitasking behaviors in younger populations whose neural architecture and study habits are still developing. Baumgartner, Weeda, van der Heijden, and Huizinga (2014) determined that frequent media multitasking adversely impacted younger adolescent executive functions including working memory. Thus, it is critical to begin to understand how early in the lifespan neurocognitive differences are associated with media multitasking.

Cognitive Load Theory (Sweller, 1988) suggests there are three forms of load that are carried by an individual's cognitive processing resources during a learning presentation, namely, intrinsic load, extraneous load, and germane load. Intrinsic load is imposed by the nature and difficulty level of the material being presented. Extraneous load is imposed by the instructional methods and materials used in the presentation. Germane load is the mental process of taking new information and integrating it with old information such that learning occurs. Thus, the addition of intrinsic, extraneous, and germane loads equals the presentation's Total Cognitive Load (TCL). This gives rise to two primary arguments: (a) extraneous load (the most easily manipulated of the three by instructional design) must be minimized so as to maximize the cognitive resources available for the learner to process the intrinsic and germane loads and (b) TCL cannot exceed the cognitive processing resources of the learner, or the learner shuts down under excessive load. As such, given

a TCL within limits, learning best occurs when extraneous cognitive load is decreased while germane cognitive load is increased (Kirschner, 2002).

3. Methods

The goal of the study was to examine the impact of texting on students' learning. The research questions asked are: Q1: To what extent does the texting affect students' comprehension scores of the videos as compared to no texting during the video lectures? Q2: Does the texting affect the scores of the two videos differently?

3.1. Participants

Participants for this study consisted of 39 high school students from a mid-sized, independent high school in the Southwestern United States. These 39 students included 23 males and 16 females ranging in age from 15 to 18, and were in the 9th through 12th grades. We obtained participant consent and assent forms for each participant.

3.2. Instrument and Materials

Two videos were selected, each approximating 20 minutes in length and similar in level of difficulty in terms of grade-level vocabulary. Both videos were TED talks. One of the videos was entitled *The Surprising Science of Happiness*. In the video, author Dan Gilbert discusses the mind's ability to manufacture feelings of happiness under adverse circumstances, while suggesting a human tendency to overestimate the impact of both positive and negative life events. In the other video, *Shedding Light on Dark Matter*, physicist Patricia Burchat illuminates the existence and influences of dark matter and dark energy, indicating that such elements may account for 25% of the mass of the universe.

Students were encouraged to take notes while watching the videos. They were advised to take notes in a manner consistent with how they normally do, including the use of words, diagrams, and pictures. They could take notes on paper or on the computer. Multiple choice quizzes were administered at the conclusion of each video. Each quiz contained 15 questions related to the content of its respective video.

An Artificially Intelligent (AI) agent named Cheyenne was introduced to each of the participants as a friend who would try to text with them through a pop-up chat window when they watched the videos. An open-ended questionnaire was designed to elicit student perspectives as to what extent “chatting with Cheyenne” affected their note-taking ability and their efforts to recall the video subject matter.

3.3. Design and Procedure

The study was conducted with every participant on an individual basis, i.e., every student participant sat with one of the researchers to complete the whole experiment at a time convenient for the student. It took each student about one hour to complete the whole experiment. A one-factor, repeated measure design was used. Every participant took part in both the control (no-texting) treatment and the experimental (texting) treatment. They each were instructed to watch

the two videos in succession, and were told that a multiple-choice quiz would follow each video. They were allowed and encouraged to take notes. In the control treatment, the participants watched the video and took notes only. In the experimental treatment, the participants were interrupted by Cheyenne, who invited them to chat/text with her. After completing the two videos, they took an open-ended questionnaire, reflecting their experiences of the texting and non-texting treatments, their note-taking habits, and their general study habits. In an effort to mitigate any effect created by the presentation order of both the videos and the texting/no-texting options, the two treatments were alternated among the participants, resulting in four conditions.

3.4. Data Collection

Collected data artefacts included video lecture notes, texting transcripts, quiz scores and questionnaire results. SPSS was used to analyze the video quiz results and to investigate relationships between the videos, texting, and quiz results.

The conditions and number of participants for each condition can be found in Table 1. All participants were advised that any notes taken, texting transcripts, and quiz results would be gathered afterwards to aid in the research.

Table 1. Descriptive statistics of study participants

Condition	First Video	Second Video	Number of Participants
Condition A	Video A (No Texting)	Video B (Texting)	10
Condition B	Video A (Texting)	Video B (No Texting)	10
Condition C	Video B (No Texting)	Video A (Texting)	11
Condition D	Video B (Texting)	Video A (No Texting)	8

However, as shown in Table 2, neither distribution was sufficiently normal with regard to skewness for the purposes of

conducting a t-test (i.e., skew $< |2.0|$ and kurtosis $< |9.0|$; Schmider, Ziegler, Danay, Beyer, & Buhner, 2010).

Table 2. Descriptives for video lecture comprehension scores under the texting and non-texting conditions.

	Scores under Texting	Scores under No-Texting
Mean	9.87	12.15
Standard Deviation	2.35	1.60
Skewness	-0.81	1.20
Std. Error – Skewness	0.38	0.38
Kurtosis	0.41	1.00
Std. Error – Kurtosis	0.74	0.74

In an effort to obtain sufficient normality, the variables related to each condition were transformed using a Log10 transformation with reflection. The transformation produced sufficiently normal distributions with regard to skewness and kurtosis, as shown in Table 3.

4. Results

Analyses have focused on the participants' video quiz scores between texting and no-texting settings in an attempt to determine the

effect of texting on quiz scores. The no-texting condition demonstrated numerically higher quiz scores compared to the texting condition. A paired t test revealed that the difference in quiz scores between the texting condition ($N = 39, M = 9.87, SD = 2.35$) and the no-texting condition ($N = 39, M = 12.15, SD = 1.60$) were statistically significant, $t(38) = 5.15, p < .001, 95\% CI [0.16, 0.38]$. The effect size for this analysis ($d = -1.20$) was found to exceed Cohen's (1988) convention for a large effect ($d = 0.80$).

Table 3. Descriptives for video lecture comprehension scores under the texting and non-texting conditions after transformation.

	Scores under Texting	Scores under No-Texting
Mean	0.66	0.39
Standard Deviation	0.21	0.24
Skewness	-0.64	0.02
Std. Error – Skewness	0.38	0.38
Kurtosis	1.20	0.40
Std. Error – Kurtosis	0.74	0.74

To determine if the texting condition affected the two videos differently, paired t-tests were done for each video. The difference in quiz scores for the “Happiness” video texting condition ($N = 21$, $M = 10.10$, $SD = 2.43$) and no-texting condition ($N = 21$, $M = 11.71$, $SD = 1.79$) was statistically significant $t(20) = 2.54$, $p = .019$, 95% CI [0.03, 0.32]. The effect size for this analysis ($d = 0.75$) approaches Cohen’s (1988) convention for a large effect ($d = 0.80$). The difference in quiz scores for the “Dark Matter” video texting condition ($N = 18$, $M = 9.61$, $SD = 2.30$) and no-texting condition ($N = 18$, $M = 12.67$, $SD = 1.19$) was also statistically significant $t(17) = 5.18$, $p < .001$, 95% CI [0.22, 0.53]. The effect size for this analysis ($d = 1.85$) greatly exceeds Cohen’s (1988) convention for a large effect ($d = 0.80$). Thus, the texting condition affected the “Dark Matter” video to a greater extent than the “Happiness” video, though the effect on each video was large.

5. Discussion and Conclusion

The goal of the study was to examine the high school student participants’ attentiveness and memory with regard to the video lectures in both the texting and no-texting conditions. The results of this experiment demonstrate that the introduction of a secondary task (in this case, texting) negatively impacted short-term memory of instructional content. The results also showed that the students did better with the “Happiness” video than with the “Dark Matter” video under the texting setting. The descriptive comments from the open-ended surveys at the end of the study helped explain the reasons behind these results.

Notably, many students demonstrated considerable self-awareness with regard to the perils of texting during a lecture. One student summarized, “This experience has demonstrated the importance of paying

attention to a lecture, and taking notes is affected badly when you chat.” Another student conceded that retention was adversely affected when texting. “I think that I shouldn’t chat while hearing a lecture or I will get distracted and not retain as much information. I think I won’t try to text and take notes [during lectures].” However, not every student was convinced of the adverse effects of chatting during a learning event. One student believed the experiment provided a means of proving multitasking capability. “I found that I’m able to multitask during a lecture that I would take notes in. I found that all you have to do is pay attention to the key ideas and not the little ideas in the middle.” Another student believed that texting actually aided attentiveness to the lecture, commenting that “I think chatting is just fine unless you start discussing some sort of emotional issue or something that will engulf you more than necessary, but just friendly shallow conversations help me pay attention.”

In addition, the descriptive comments from the students revealed that despite the similarity in difficulty level of the two videos, the concepts and terminology of the “Dark Matter” video were more difficult to grasp. Regarding the “Dark Matter” video, one student summarized the thoughts of others in stating, “I pretty much just tuned out a lot of the time because I knew I wasn’t going to absorb anything. The language in the [Dark Matter] video was also a lot more complex than in the ‘Happiness’ video.” A number of students mentioned the abstractions of the subject matter as a contributing factor in having difficulty with the “Dark Matter” video. Conversely, students felt that they could identify more readily with the universality of happiness. One student noted, “Happiness is a pretty universal idea that most people have some understanding of while Dark Matter and Dark Energy is not. I was confused when

listening to the [Dark Matter] video.” Some believed the speaker for the “Happiness” video to be more humorous and engaging as well.

The results of the study provided support for cognitive overload theory in that texting with friends added additional extraneous load to students' mental process of the information, which was to comprehend and remember the video content for follow-up quizzes. Meanwhile, the nature and difficulty levels of the videos played a role in students' performance. Although the difficulty levels of the two videos were similar in grade-level vocabulary, the content of the “Dark Matter” video was less familiar for the students than that of the “Happiness” video. One student remarked, “I was able to gravitate more with the examples and dialogue of the first speaker [Happiness video] whereas a lot of vocabulary and subject matter in the second video [Dark Matter video] was difficult and rather dry.” As a result, it was harder for the students to integrate new information with prior knowledge they may have. All these have caused cognitive overload for the students.

Schools and teachers are continuously pressured to incorporate new media and technologies in teaching and learning environments to improve students' learning, and to help students obtain knowledge and skills that meet the 21st century workforce requirements and competitions. With online, one-on-one computing, bring-your-own-device (BYOD), mobile, game-based, and 3-D technologies increasingly integrated into the classrooms and learning processes, media multitasking is becoming a given. The students' learning environments have become more complex than ever. It is hoped that the evidence provided in this limited study informs decisions regarding policies and practices of device utilization, as well as instructional design and classroom facilitation.

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Resource

Ted Talks by Dan Gilbert: The Surprising Science of Happiness:

https://www.ted.com/talks/dan_gilbert_asks_why_are_we_happy?language=en

Ted Talks by Patricia Burchat: Shedding Light on Dark Matter:

https://www.ted.com/talks/patricia_burchat_leads_a_search_for_dark_energy?language=en

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